

## Assignment 2

Textbook Assignment: "Atmospheric Physics" (Continued); "Atmospheric Circulation. "  
Pages 2-4-1 through 3-3-23.

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Learning Objective: Describe the adiabatic process and determine how stability and instability affect the atmosphere.

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- 2-1. When a parcel of air rises in the atmosphere, what happens to the parcel and the surrounding air?
1. The parcel expands due to lessening pressure, and its temperature, pressure, and density increase
  2. The parcel contracts due to increasing pressure, and its temperature, pressure, and density decrease
  3. The parcel expands due to lessening pressure, and its temperature, pressure, and density decrease
  4. The parcel contracts due to lessening pressure, and its temperature, pressure, and density increase
- 2-2. With regard to Earth's atmosphere, which of the following definitions pertains to temperature lapse rate?
1. The rate at which temperatures decrease or increase with altitude
  2. The rate at which temperatures decrease at night
  3. The rate of temperature decrease latitudinally
  4. The rate of temperature decrease horizontally
- 2-3. What is an inversion?
1. A decrease in temperature with height
  2. An isothermal lapse rate
  3. An increase in temperature due to subsidence
  4. An increase in temperature with height
- 2-4. If a parcel of air is lifted and remains unsaturated, it will cool at which of the following rates?
1. 1°C per 100 meters
  2. 2° or 3°C per 100 meters
  3. 5°C per 100 meters
  4. 10° C per 100 meters
- 2-5. When the actual lapse rate of a column of air is less than the dry adiabatic lapse rate but greater than the moist adiabatic lapse rate, what can we say about the air?
1. It is absolutely stable
  2. It is absolutely unstable
  3. It is conditionally stable, only
  4. It may be conditionally stable or unstable
- 2-6. A maritime polar air mass moves into western Canada and is forced aloft by the mountains of British Columbia. Prior to being lifted by the mountains, the layer of air between 850 mb and 500 mb was quite moist up to 600 mb and dry above. What should you expect concerning the stability of this layer?
1. Instability to remain the same
  2. Instability to decrease
  3. Instability to increase
  4. Stable conditions to prevail throughout the layer
- 2-7. Where would you most likely be able to determine the bases of convective clouds using surface temperatures and dewpoints?
1. Adak, Ak
  2. San Antonio, Tx
  3. San Diego, CA
  4. South China Sea

- 2-8. Stratified cloud layers on the western slope of the Appalachian Mountains of Virginia would be an indication of which of the following conditions?
1. Little or no turbulence
  2. Unstable air
  3. Hazardous flying conditions along the mountains due to strong vertical currents
  4. All of the above

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Learning Objective: Recognize the affects of pressure and temperature on Earth's general circulation and explain the tri-cellular theory.

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- 2-9. The unequal heating of Earth's surface is due to which of the following factors?
1. Its axis (inclination)
  2. Its rotation
  3. Differential insolation
  4. All of the above
- 2-10. Incoming solar radiation is greatest at the equator and least at the poles. What affect, if any, does this have on the atmospheric pressure in these areas?
1. Pressure is high in both areas
  2. Pressure is higher at the poles than at the equator
  3. Pressure is lower at the poles than at the equator
  4. Incoming solar radiation has no effect on pressure in these locations
- 2-11. If Earth did not rotate and its surface was uniform, in the Northern Hemisphere its surface winds would blow in what direction?
1. West to east
  2. East to west
  3. North to south
  4. South to north
- 2-12. Coriolis force is an apparent force created by
1. temperature variations between the poles and equator
  2. the tilt of the Earth's axis
  3. the Earth's rotation
  4. pressure variation between the poles and equator

- 2-13. How does Coriolis force affect moving objects?
1. It produces positive temperature changes on them
  2. It lessens the pressure gradient on them
  3. It increases and decreases their speed
  4. It forces objects to the right of their intended path in the Northern Hemisphere

- 2-14. The three cells of the tri-cellular theory are the

1. tropical, subtropical, and polar
2. equatorial, subtropical and polar
3. tropical, midlatitude, and polar
4. equatorial, midlatitude, and polar

- 2-15. The surface wind generated by the Earth's general circulation pattern is

1. westerly at all latitudes
2. northeasterly in the tropics and poleward of 60° N/S and westerly in the midlatitudes
3. northwesterly in the tropics and poleward of 60° N/S and westerly in the midlatitudes
4. northwesterly poleward of 60 N/S, northeasterly in the midlatitudes and easterly in the tropics

- 2-16. Which of the following regions feature(s) light and variable winds?

1. The doldrums
2. The horse latitudes
3. The regions near 30 N and 30 S
4. All of the above

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Learning Objective: Define pressure gradient, centrifugal force and friction, and describe their effects on wind.

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- 2-17. What force moves air in a straight line from areas of high pressure to areas of low pressure?

1. Friction
2. Centrifugal
3. Pressure gradient
4. Coriolis

2-18. What is inferred from horizontal pressure gradients classified as flat or weak?

1. Isobars are closely spaced
2. Isobars are widely spaced
3. The winds are light
4. Both 2 and 3 above are correct

2-19. The latest upper-air sounding shows the 1000-700 mb layer over your station has decreased in thickness over the last 24 hours. What does this change in thickness tell you, if anything, about the vertical pressure gradient within this stratum?

1. It has increased
2. It has decreased
3. The gradient remains unchanged because the pressures have not changed
4. Nothing without height figures

2-20. Which of the following forces has the greatest effect on wind speed?

1. Centrifugal
2. Pressure gradient
3. Friction
4. Coriolis

2-21. Which of the following forces causes the wind to begin moving from areas of high pressure toward areas of low pressure?

1. Centrifugal
2. Pressure gradient
3. Friction
4. Coriolis

2-22. What effect does centrifugal force have on cyclonic circulation?

1. It forces air out away from the center
2. It pulls air toward the center
3. It pushes air toward the center
4. It forces air from high to low pressure

2-23. What effect, if any, does the wind speed have on the centrifugal force in a high pressure system?

1. The higher the wind speed, the greater the force
2. The higher the wind speed, the smaller the force
3. The force is inversely proportional to the wind speed
4. None, the force is independent of the wind speed

2-24. Friction affects wind velocities at what levels?

1. The surface only
2. All levels
3. All levels up to the gradient level

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Learning Objective: Define geostrophic, gradient and cyclostrophic wind, and recognize the effect of pressure gradient, centrifugal, coriolis, and frictional force on each type of wind.

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IN ANSWERING QUESTIONS 2-25 THROUGH 2-27, MATCH THE DEFINITION IN COLUMN B WITH THE TYPE OF WIND IN COLUMN A.

	<u>A. TYPES OF WIND</u>	<u>B. DEFINITIONS</u>
2-25.	Geostrophic	1. A wind that parallels straight isobars or isoheights
2-26.	Gradient	
2-27.	Cyclostrophic	2. A wind that parallels curved isobars or isoheights
		3. A wind that approximates the gradient wind without Coriolis force being a factor

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2-28. At 40,000 feet, which of the following balances of forces causes the wind to blow parallel to curved isoheights?

1. The centrifugal force and Coriolis force are in balance
2. The centrifugal force and pressure gradient force are in balance
3. The centrifugal and centripetal forces are balanced
4. The pressure gradient force and centripetal force are in balance

2-29. A low-pressure system over the Virginia Capes moves northeast without any changes occurring in the density of the air or to the pressure gradient. What happens to the gradient wind speed?

1. It decreases due to the easterly movement
2. It increases due to the northerly movement
3. It decreases due to the northerly movement
4. It remains the same

2-30. An extratropical low-pressure system is stationary 200 n. mi. south of Kamchatka. With the density of the air remaining the same and the pressure gradient decreasing, what happens to the gradient wind speed associated with this low?

1. It decreases
2. It increases
3. It remains the same
4. Both 2 and 3 are possible

2-31. Around high-pressure systems, Coriolis force opposes the

1. gradient force only
2. centrifugal force only
3. pressure gradient force and centrifugal force
4. centripetal force

2-32. Coriolis force always opposes the pressure gradient force around cyclones and anticyclones.

1. True
2. False

2-33. When measuring the gradient winds around low- and high-pressure systems using a geostrophic wind scale, how do geostrophic wind speeds compare to gradient wind speeds?

1. Geostrophic winds are stronger than the gradient winds around both systems
2. Geostrophic winds are weaker around lows and stronger around highs
3. Geostrophic winds are stronger around lows and weaker around highs
4. They do not differ

2-34. What are the most common geostrophic wind scale increments?

1. 2 mb and 15 meters
2. 4 mb and 30 meters
3. 4 mb and 60 meters
4. 8 mb and 120 meters

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Learning Objective: Define secondary circulation, anti-cyclone and cyclone, and differentiate between centers of action and migratory systems. Also, recognize the role the seasons play in controlling the secondary circulation.

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2-35. Which of the following statements defines Earth's secondary circulation?

1. The circulations is created and maintained by the effect of Earth's non-uniform surface and composition
2. The circulation is created by thermal differences in the atmosphere
3. It is that portion of the tertiary circulation caused by thermal differences between land and water
4. The circulation is created and maintained by the effects of Earth's non-uniform surface and composition and Earth's thermal differences

2-36. Centers of action are created by

1. wind
2. seasonal temperature differences
3. temperature differences between land and water
4. pressure belts

2-37. What is the name given to the permanent and semi-permanent high- and low-pressure cells?

1. Thermal cells
2. Migratory cells
3. Centers of action
4. Primary circulations

2-38. Some centers of action disappear at certain times of year.

1. True
2. False

2-39. In winter, what pressure systems are found in the Northern Hemisphere over Siberia, the eastern Pacific Ocean, and the eastern Atlantic Ocean?

1. High pressure at all three locations
2. LOW pressure covers Siberia, while high pressure is found over the eastern Pacific and Atlantic
3. LOW pressure at all three locations
4. High pressure covers Siberia, while low pressure is found over the eastern Pacific and Atlantic

2-40. How are the subtropical high pressure systems affected, if at all, by seasonal changes?

1. They are weaker in summer and farther poleward
2. They are stronger in summer and farther poleward
3. They are stronger in summer and nearer the equator
4. They are not affected

2-41. Which of the following pressure systems is NOT classified as a center of action?

1. Aleutian low
2. Bermuda high
3. Polar high
4. Hatteras low

2-42. Where is the largest individual secondary circulation cell in the Northern Hemisphere located?

1. North American continent
2. Asian continent
3. African continent
4. European continent

2-43. Migratory wind circulations are not classified as centers of action. why?

1. They are seasonal
2. They are not as intense
3. They are found only in midlatitudes
4. They are not persistent in location or intensity

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Learning Objective: Recognize the vertical structure of pressure systems.

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2-48. Pressure-system movement, shape and intensity are dependent on what factor?

1. Circulation
2. Temperature
3. Height
4. Thickness

2-49. An anticyclonic circulation in the Southern Hemisphere whose temperature pattern is such that colder temperatures are located at the circulation center is known as a

1. warm-cored low
2. warm-cored high
3. cold-cored low
4. cold-cored high

2-50. Which of the following systems have the greatest vertical extent?

1. Cold-cored lows and highs
2. Warm-cored lows and highs
3. Warm-cored lows and cold-cored highs
4. Cold-cored lows and warm-cored highs

2-51. Well developed cyclonic and anticyclonic closed circulations at the surface may or may not be evident on upper-level charts, and the same type circulations may appear on upper-level charts and not be evident at the surface.

1. True
2. False

IN ANSWERING QUESTIONS 2-44 THROUGH 2-47, SELECT THE DEFINITION LISTED IN COLUMN B THAT MATCHES THE TERM LISTED IN COLUMN A.

	<u>A. TERMS</u>	<u>B. DEFINITIONS</u>
2-44.	Anticyclone	1. An area of relatively low pressure with a counter-clockwise circulation in the Northern Hemisphere
2-45.	Anticyclogenesis	
2-46.	Cyclone	
2-47.	Cyclolysis	2. A weakening cyclonic circulation
		3. An area of relatively high pressure with a counter-clockwise circulation in the Southern Hemisphere
		4. A developing anticyclonic circulation

2-52. How does a closed cyclonic circulation in the Northern Hemisphere with warmer temperatures toward the circulation center differ from a similar circulation with colder temperatures toward the center?

1. It does not extend as far into the atmosphere
2. Its intensity lessens with height
3. It is classified as a warm-cored low
4. All of the above

2-53. A migratory closed circulation that extends well into the atmosphere is classified as

1. warm-cored
2. cold-cored
3. dynamic
4. vertically axisd

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Learning Objective: Recognize tertiary circulations and describe how they affect local weather.

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- 2-54. Tertiary circulations are small, localized circulations created by which of the following conditions?
1. Local heating and cooling
  2. Adjacent heating and cooling
  3. Induction
  4. All of the above
- 2-55. The monsoons of India and southeast Asia are seasonal in nature, and in winter, the monsoon winds are normally accompanied by what weather conditions?
1. Constant heavy rain
  2. Heavy rainshowers and thunderstorms
  3. Both 1 and 2 are correct
  4. Mostly clear skies
- 2-56. A sea breeze can be expected to reach its maximum intensity between what hours?
1. 0600 to 0800 local
  2. 0900 to 1100 local
  3. 1400 to 1600 local
  4. 2000 to 2200 local
- 2-57. Sea breezes are most pronounced during which of the following seasons?
1. Winter
  2. Late winter and early spring
  3. Late spring, summer and early autumn
  4. Late autumn to early spring
- 2-58. Mountains act as barriers to wind; however, if there are valleys or passages through the mountains, the wind may pass through at great speeds. Which of the following factors controls the wind speeds through such openings?
1. The orientation of the mountain range
  2. The pressure difference on each side of the mountain
  3. The pressure pattern on each side of the mountain
  4. Each of the above
- 2-59. Which of the following names applies to the cold dense air of the Greenland ice cap [10,000 feet above sea level) when it is set in motion and rushes down the cap to sea level?
1. Glacier wind
  2. Mountain wind
  3. Gravity wind
  4. Each of the above
- 2-60. What is a thermal?
1. A warm dry wind that begins at the base of a mountain and ascends the mountain slope
  2. A warm moist wind that begins at the base of a mountain and ascends the mountain slope
  3. A relatively small-scale convective current produced by strong local heating
  4. Turbulence created by moderate to strong airflow over rough or hilly terrain
- 2-61. Which of the following types of rotation is/are induced in eddies, dust devils and waterspouts?
1. Cyclonic in the Northern Hemisphere; anticyclonic in the Southern Hemisphere
  2. Anticyclonic in the Northern Hemisphere; cyclonic in Southern Hemisphere
  3. Cyclonic only
  4. Cyclonic or anticyclonic, independent of the hemisphere
- 2-62. When winds in excess of 20 knots blow perpendicular to a mountain range, what wind conditions might be expected on the lee side?
1. Updrafts only
  2. Strong downdrafts
  3. Very turbulent conditions
  4. Both 2 and 3
- 2-63. Under which of the following wind conditions may turbulence be expected?
1. Winds blow in the same direction but at different speeds
  2. Wind currents blow past each other in opposite directions
  3. Winds blow over uneven surfaces
  4. Each of the above

2-64. Mountain waves are an example of

1. large-scale vertical eddies
2. small-scale vertical eddies
3. large-scale horizontal eddies
4. small-scale horizontal eddies

IN ANSWERING QUESTIONS 2-65 THROUGH 2-68, SELECT FROM COLUMN B THE FACTS OR EXAMPLES THAT APPLY TO THE TERTIARY WINDS LISTED IN COLUMN A.

A. TERTIARY WINDS	B. FACTS AND/OR EXAMPLES
2-65. A Foehn wind	1. Horizontal and vertical circulations created when winds blow over rough terrain, mountains or other obstructions
2-66. Eddies	2. Convective currents common over bare rocky hills and sand dunes
2-67. Thermals	3. Warm katabatic winds
2-68. valley breeze	4. An ascending wind generally restricted to southward facing mountain slopes

IN ANSWERING QUESTIONS 2-69 THROUGH 2-72, SELECT FROM COLUMN B THE FACTS OR EXAMPLES THAT APPLY TO THE TERTIARY WINDS LISTED IN COLUMN A.

A. TERTIARY WINDS	B. FACTS AND/OR EXAMPLES
2-69. Mountain gap winds	1. Onshore winds that occur with great regularity in the tropics
2-70. Drainage winds	2. Winds that blow onshore in summer and offshore in winter
2-71. Monsoon	3. Light cool, katabatic winds (winds greater than 15 knots are rare)
2-72. Sea breezes	4. Winds whose existence is based on Bernoulli's theorem